

Cystopteris bulbifera in the Southwestern United States

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The Bulblet Fern occurs primarily in eastern North America and reaches its southwestern distributional limit in Arizona (*Fig. 1*). The eastern distribution is fairly continuous as far west as the eastern edge of the Great Plains, where populations become sporadic. A gap of about 1000 km separates known localities in eastern Nebraska and Oklahoma from sites in New Mexico and Texas (Wagner, 1972). Anderson (1974) discussed the distribution of this species in the Great Plains but not in the Southwest. *Cystopteris bulbifera* (L.) Bernh. is known in Texas only in the Guadalupe Mountains, Culberson Co. (Correll & Johnston, 1970). New Mexican collections have been made in these same Guadalupe Mountains, Otero or Eddy Co. (Blasdell, 1963, p. 67); in the White Mountain wilderness, northern Otero Co. (C. R. Hutchins, pers. comm.); and north of Taos, Taos Co. (Dittmer, et al., 1954, p. 28). In Utah, Flowers (1944) reported the species from Zion National Park, Washington Co.; Elk Mountain, San Juan Co.; and Brighton and Little Cottonwood Canyon, Salt Lake Co. There are no reports of this species from Colorado, Nevada, or farther north. In Arizona, *C. bulbifera* has previously been known only from the West Fork of Oak Creek Canyon, Coconino Co. (Kearney, et al., 1960, p. 44). I have recently collected specimens of it in Walnut Canyon, Coconino Co., at a site about 40 km northeast of the Oak Creek locality. A recent floristic study of Walnut Canyon by Joyce (1974) does not mention the occurrence of *C. bulbifera*, but my examination of his collections has revealed one specimen of this species (*Joyce WC634*, ASC) misidentified as *C. fragilis* (L.) Bernh.

Blasdell (1963, p. 28) stated that *C. bulbifera* usually grows on neutral soils associated with limestone, whereas Anderson (1974) indicated that in Nebraska it occurs on sandstone. In Arizona, I have collected this species on both substrates. *Cystopteris bulbifera* is abundant in the lower portion of the West Fork of Oak Creek Canyon (1550 m), occurring in large colonies on the red sandstone talus and cliffs capped by Kaibab limestone. Associated fern species are *Adiantum capillus-veneris*, *A. pedatum*, and *Polypodium hesperium*. At higher elevations in the canyon (2000 m), where *Cystopteris fragilis*, *Dryopteris filix-mas*, and *Polystichum lonchitis* are found, the Bulblet Fern occurs on limestone outcrops and boulders. At Walnut Canyon, *C. bulbifera* occurs in a few small colonies at 1800 m in the narrow gorge to the southwest of the Walnut Canyon National Monument Headquarters. Here, the plants grow in shaded seepage sites on vertical cliffs of Kaibab limestone. Associated species are *Cheilanthes feei*, *Cystopteris fragilis*, and *Selaginella underwoodii*. Putative hybrids between *C. bulbifera* and *C. fragilis* from Walnut Canyon are currently under investigation.

Since the only previously reported chromosome counts for *C. bulbifera* were based on specimens from eastern North America, an attempt was made to obtain

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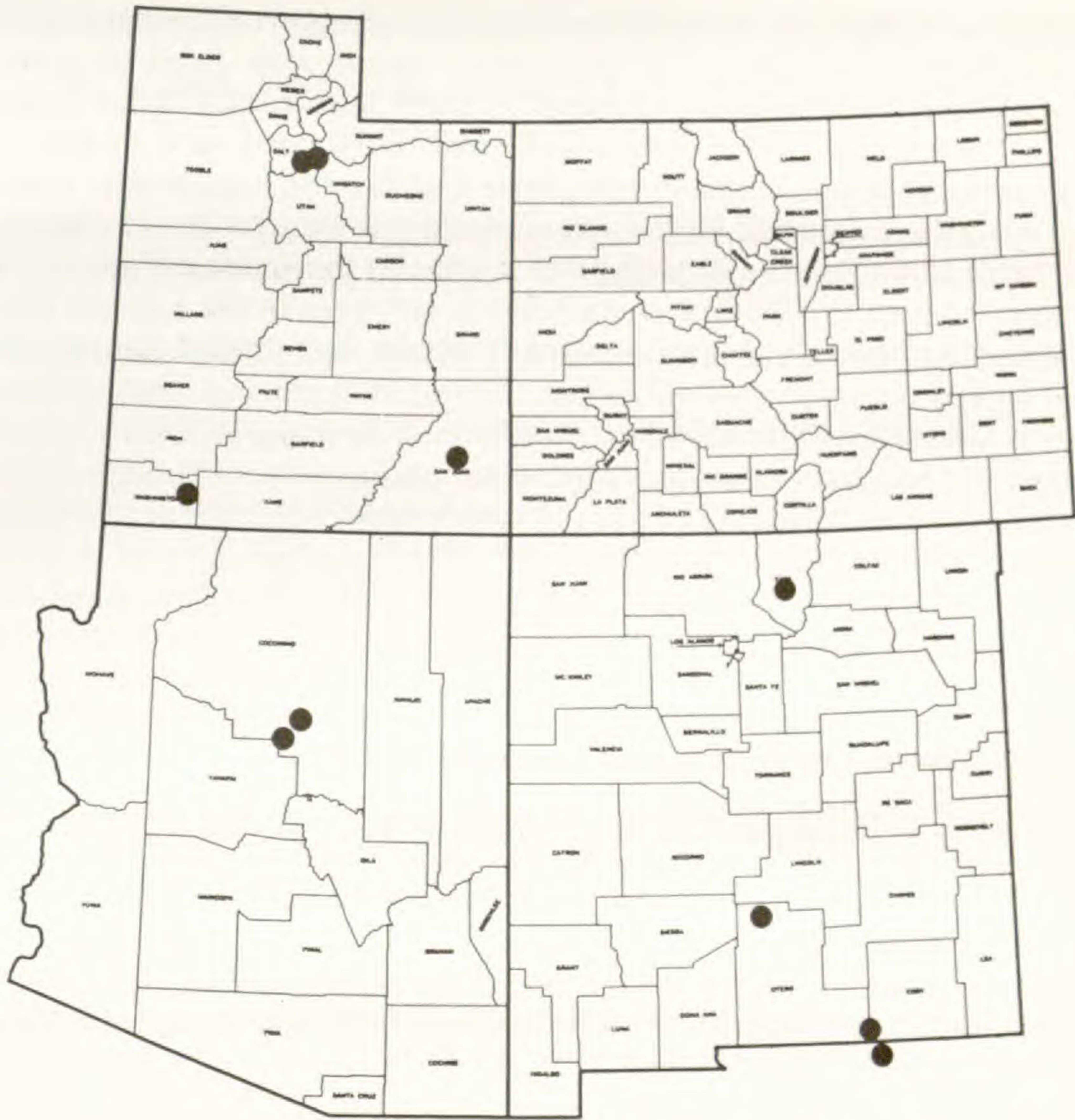


FIG. 1. Known distribution of *Cystopteris bulbifera* in the southwestern United States.



FIG. 2. Camera lucida drawing of meiotic chromosomes of *Cystopteris bulbifera* at metaphase I showing 42 pairs of chromosomes (Walnut Canyon, Coconino County, Arizona, Reeves 3030A, ASU).

counts on Arizona material. Specimens of this species were collected in both Oak Creek and Walnut Canyons on 17 June 1975. Pinnae were fixed in modified Carnoy's fixative (6 chloroform: 4 ethanol: 1 glacial acetic acid). After 24 hours the material was transferred to 70% ethanol and refrigerated until studied. Developing sporangia were stained in iron aceto-carmin and squashed in Hoyer's medium. All cells studied had normal chromosome pairing with $2n=42$ pairs (Fig. 2). This agrees with all previously reported counts for the species (Table 1). The counts reported here are the first reports for *C. bulbifera* in the western United States, indicating that this species apparently occurs as a diploid throughout its range.

TABLE 1. CHROMOSOME NUMBERS IN *Cystopteris bulbifera*.

Number	Voucher or reference	Locality
$n = 42$	Britton (1953)	Canada: Ontario
42	Wagner (1955)	Ohio: Ross Co.
42	Wagner (1955)	Michigan: Oakland Co.
42	Wagner & Hagenah (1956)	Michigan: Ionia Co.
42	Wagner & Hagenah (1956)	Michigan: Eaton Co.
42	Reeves 3026A (ASU)	Arizona: Walnut Canyon, Coconino Co.
42	Reeves 3030A (ASU)	Arizona: Walnut Canyon, Coconino Co.
42	Reeves 3046D (ASU)	Arizona: Oak Creek Canyon, Coconino Co.

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